



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services



Solutions

## Technical Information

# ISEmax CAS40D

Online measurement of nutrient parameters

Ion-selective electrodes for the continuous measurement of ammonium, nitrate and other ions



### Application

The ion-selective sensor works directly in the activated sludge basin of the sewage treatment plant without any sample conditioning or sample transportation.

A complete measuring system consists of a sensor with electrodes and a transmitter with display and operating elements.

The sensor is used to monitor the ammonium and nitrate content

- in the activated sludge basin
- in the preclarification outlet.

### Your benefits

- Reliable, cost-saving unit:
  - Direct measurement of ammonium or nitrate without costly sample conditioning
  - Optional potassium and/or chloride measurement, also to compensate high concentrations of interference ions
  - pH measurement as standard
  - Low operating costs since no reagent used
- Versatile and flexible:
  - Large measuring range 0.1-1000 mg/l  $\text{NH}_4\text{-N}$  or 0.1-1000 mg/l  $\text{NO}_3\text{-N}$
- Easy-to-use and safe:
  - Installed directly on the basin rim, no measuring container or sample-conveying pump required
  - Minimum maintenance thanks to compressed air cleaning
  - Membrane cap replacement every 6 months prolongs electrode service life
  - Standardized communication enables Plug&Play

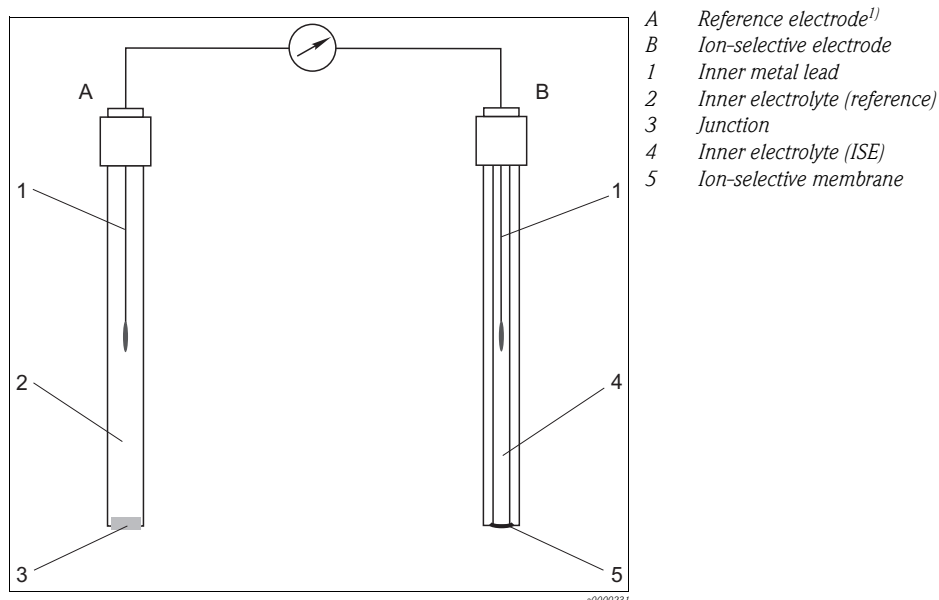
## Function and system design

### Measuring principle

At the heart of the ion-selective electrode (ISE) is a membrane that is selective for the ion to be measured. An ionophore is integrated into the membrane which facilitates the selective "migration" of a specific type of ion (e.g. ammonium or nitrate) to the electrode.

As a result of ion migration, a change in the charge occurs, causing the creation of a potential that is proportional to the ion concentration logarithm. The potential is measured against a reference electrode with a constant potential and converted to a concentration using the Nernst equation.

With the potentiometric measuring principle, the color and turbidity do not affect the measurement result.



- 1) When using a pH single-rod measuring cell such as the CPS11, its reference is also the reference electrode for the overall sensor and for the pH electrode itself.

### Interference

Depending on the selectivity of the ion-selective electrode vis-à-vis other ions (interference ions), and the concentration of these ions, such ions could also be interpreted as part of the measuring signal and thus cause measuring errors.

When measuring in wastewater, the potassium ion which is chemically similar to the ammonium ion can cause higher measured values.

The measured values for nitrate can be too high due to high concentrations of chloride.

To reduce measuring errors resulting from such cross-interference, the concentration of the potassium or chloride interference ion can be measured and compensated for with a suitable additional electrode.

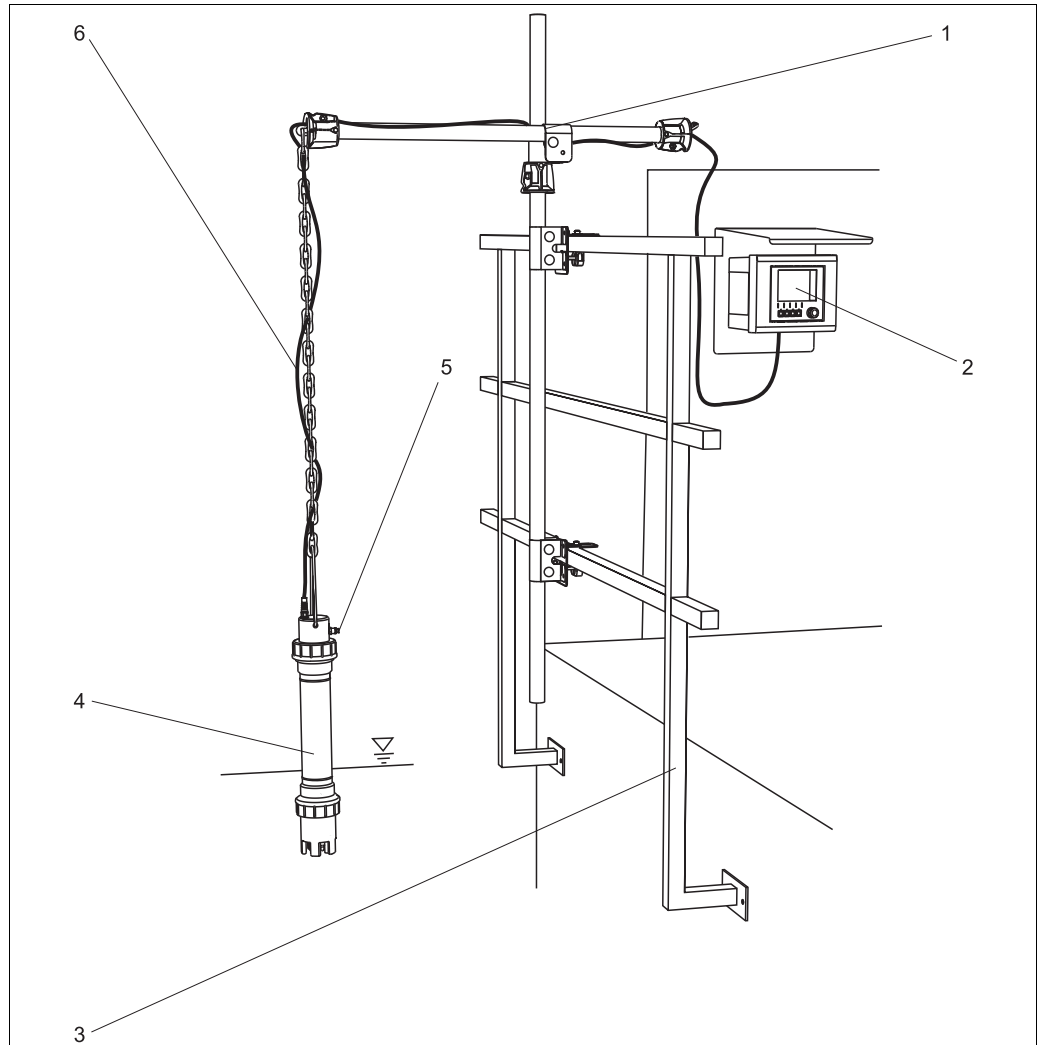
**Measuring system**

A complete measuring system comprises:

- Sensor CAS40D
  - Ion-selective electrode(s) for ammonium, nitrate, potassium or chloride
  - pH glass electrode, Orbisint CPS11-1AT2GSA
  - Temperature sensor, CTS1
- Transmitter, e.g. Liquiline CM442

Optional

- Assembly holder, e.g. CYH112
- Weather protection cover - absolutely essential if mounting the transmitter outdoors!
- Compressed air generator (if no compressed air available on site)



*Example: measuring system on basin rim*

- |   |  |
|---|--|
| <p>1 Wastewater assembly holder, secure to rail, with transverse pipe and chain</p> <p>2 Transmitter, e.g. Liquiline CM442 (in graphic: wall-mounted with weather protection cover)</p> <p>3 Rail</p> | <p>4 Sensor CAS40D with ion-selective electrodes</p> <p>5 Connection for optional compressed air cleaning (not in graphic)</p> <p>6 Sensor cable</p> |
|---|--|

80015206

## Input

### Measured variables

Depending on version:

- Ammonium:  $\text{NH}_4\text{-N}$ ,  $\text{NH}_4^+$  [mg/l]
- Nitrate:  $\text{NO}_3\text{-N}$ ,  $\text{NO}_3^-$  [mg/l]
- Potassium,  $\text{K}^+$  [mg/l]
- Chloride,  $\text{Cl}^-$  [mg/l]
- pH value
- Temperature

### Measuring ranges

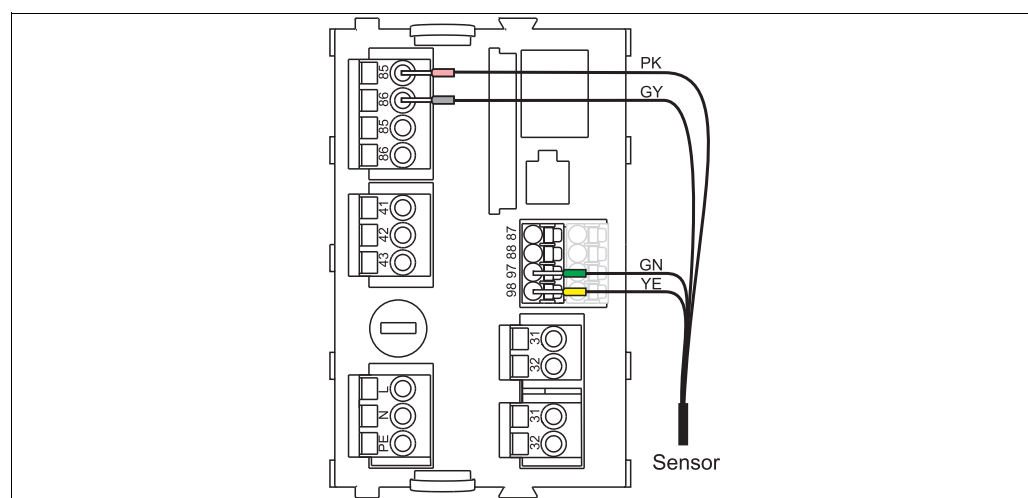
- Ammonium:  
0.1 to 1000 mg/l ( $\text{NH}_4\text{-N}$ )
- Nitrate:  
0.1 to 1000 mg/l ( $\text{NO}_3\text{-N}$ )
- Potassium:  
1 to 1000 mg/l
- Chloride:  
1 to 1000 mg/l

## Wiring

### Electrical connection

The sensor will be connected to the transmitter as follows:

- With the M12 plug (version: fixed cable, M12 plug) or
- With the fixed cable connected to the terminal strips (version: fixed cable, end sleeves):



*Sensor connection*

40012460

The maximum cable length is 100 m (328 ft).

## Performance characteristics

<b>Response time <math>t_{90}</math><sup>1)</sup></b>	<ul style="list-style-type: none"> <li>■ Ammonium: &lt; 2 min.</li> <li>■ Nitrate: &lt; 2 min.</li> <li>■ Potassium: &lt; 2 min.</li> <li>■ Chloride: &lt; 2 min.</li> </ul>
---	--

<b>Maximum measured error</b>	$\pm 5\%$ of the measured value $\pm 0.2$ mg/l
-------------------------------	--

<b>Repeatability</b>	$\pm 3\%$ of the display value
----------------------	--------------------------------

### Compensation

Sensor	Temperature	pH	Potassium <sup>1)2)</sup>	Chloride <sup>1)3)</sup>
Ammonium	2 to 40 °C (36 to 100 °F)	pH 8.3 to 10	1 to 1000 mg/l (ppm)	-
Nitrate		-	-	10 to 1000 mg/l (ppm)
Potassium		-	-	-
Chloride		-	-	-

- 1) The fluctuations in concentration, not the absolute value, are the determining factor
- 2) Recommendation: Use as compensation electrode for potassium concentrations > 40 mg/l in the case of simultaneously fluctuating values of  $\pm 20$  mg/l, or apply an offset in the case of non-fluctuating values.
- 3) Recommendation: Use as compensation electrode for chloride concentrations > 500 mg/l in the case of simultaneously fluctuating values of  $\pm 100$  mg/l, or apply an offset in the case of non-fluctuating values.

<b>Maximum operating life</b>	Membrane and electrolyte
-------------------------------	--------------------------

- Use:  
0.5 years
- Storage:  
2 years

### Automatic cleaning

- Cleaning medium:  
Air
- Pressure:  
3 to 3.5 bar (30 to 50 psi)
- Volume of air required per cleaning cycle:  
3 to 4 l (0.8 to 1 US gal)
- Cleaning duration:  
4 to 15 s
- Cleaning intervals (at  $T > 10$  °C (50 °F)):  
Sludge activation inlet: 15 s cleaning, 30 min pause  
Sludge activation: 15 s cleaning, 1 hour pause

1) For a change between 0.5 and 1 mmol/l in both directions, at 25 °C (77 °F)

---

## Environment

---

<b>Ambient temperature range</b>	-20 to 50 °C (-4 to 120 °F)
<b>Storage temperature</b>	2 to 40 °C (36 to 100 °F)
<b>Protection class</b>	IP 68
<b>Electromagnetic capability</b>	Interference emission and interference immunity as per EN 61326, Namur NE21

---

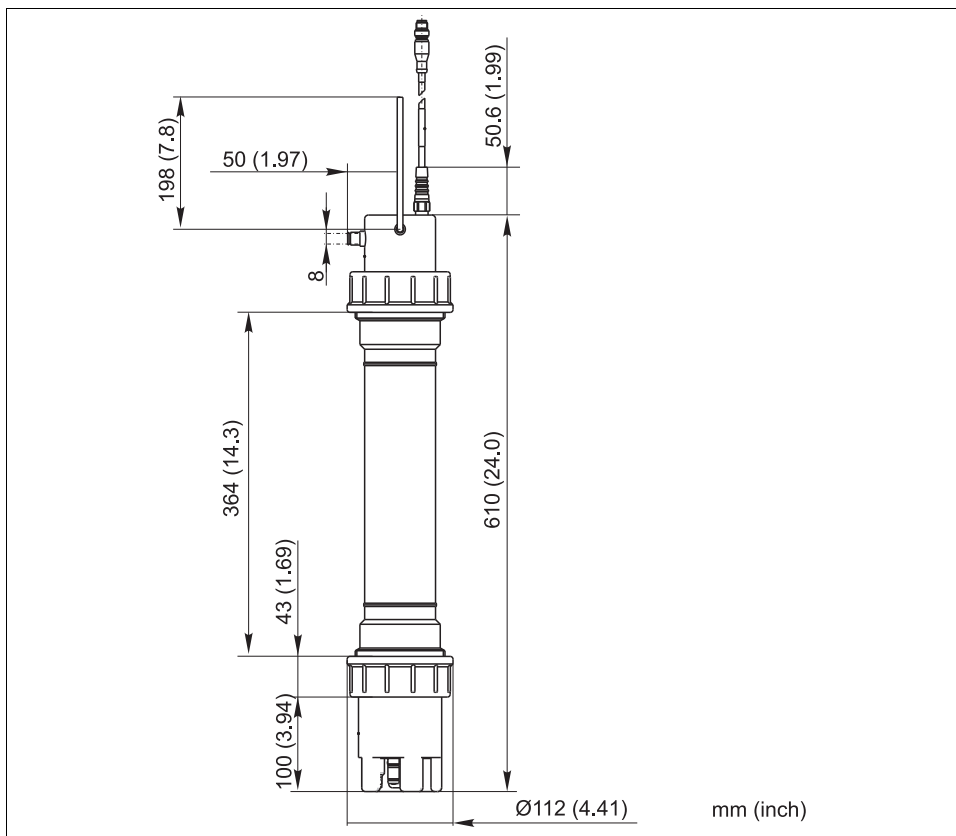
## Process

---

<b>Process temperature range</b>	2 to 40 °C (36 to 100 °F)
<b>Process pressure</b>	400 mbar (160 inH <sub>2</sub> O) max. permitted overpressure
<b>pH value of the medium</b>	<ul style="list-style-type: none"><li>■ Ammonium: pH 5 to 8.3 (without pH compensation) pH 5 to 10 (with pH compensation)</li><li>■ Nitrate: pH 2 to 12</li><li>■ Potassium: pH 2 to 12</li><li>■ Chloride: pH 1 to 10</li></ul>

## Mechanical construction

### Dimensions



Dimensions CAS40D

a0015207

### Weight

Approx. 3.5 kg (7.7 lbs)

### Material

Sensor	
- Protective cage:	POM
- Electrode holder:	POM
- Flat seals:	Silicon
- O-rings for electrode holder and sensor head:	EPDM
- O-rings in ISE holder:	EPDM
- O-rings for air nozzle:	Viton
- Sensor pipe with coupling nut:	PP
- Retaining bracket:	Stainless steel
- Sensor head:	POM
- Temperature sensor:	Glass
- pH single-rod measuring cell with reference:	Glass, PTFE
Ion-selective electrodes	
- Membrane cap:	POM
- Shaft:	POM
- Color ring:	PP
- Membrane:	PVC, plasticizer
- O-rings:	EPDM

**Electrode process connection** Pg 13.5

**Compressed air connection** for hose with OD 8 mm

## Certificates and approvals

### CE approval

#### Declaration of conformity

The product meets the requirements of the harmonized European standards. It thus complies with the legal requirements of the EC directives.

The manufacturer confirms successful testing of the product by affixing the CE symbol.

## Ordering information

### Product structure

Approval	
AA	Non-hazardous area
Version	
1	Immersion operation, pH electrode CPS11, temperature sensor CTS1
ISE slot 1	
A1	Ammonium
B1	Nitrate
C1	Potassium
D1	Chloride
Adapter cable	
A	Fixed cable, ferrules
B	Fixed cable, M12 connector
Cable length	
1	3 m
2	7 m
3	15 m
7	... m, specify the desired length.
8	... ft, specify the desired length.
CAS40D-	Complete order code
ISE slot 2 (optional, single selection only)	
F1	Ammonium
F2	Nitrate
F3	Potassium
F4	Chloride
ISE slot 3 (optional, single selection only)	
G1	Ammonium
G2	Nitrate
G3	Potassium
G4	Chloride
Identification (optional, multiple selection possible)	
Z1	Measuring point (day), see additional spec.

To obtain a valid order code, simply append the optional features to the order code. If you have any questions, please contact your sales center.

### Scope of delivery

The scope of delivery comprises:

- 1 sensor (version as per nameplate)
- 1 socket key
- 1 Operating Instructions



## Accessories

- i** In the following sections, you find the accessories available at the time of issue of this documentation. For information on accessories that are not listed here, please contact your local service or sales representation.

### Assembly holder

- Holder system Flexdip CYH112 for water and wastewater assembly Flexdip CYA112
- Modular holder system for sensors and assemblies in open basins, channels and tanks
  - The holder system CYH112 works for nearly any type of fixing – fixing on the floor, wall or directly on a rail.
  - Material: stainless steel
  - Ordering acc. to product structure (Technical Information TI430C/07/en)

### Maintenance kits

- Membrane kit
- 2 membrane caps (with chloride only 1 membrane cap with crystal)
  - Electrolyte
  - Order numbers:
    - Ammonium: 71072574
    - Nitrate: 71072575
    - Potassium: 71072576
    - Chloride: 71072577
- Maintenance kit for chloride electrode
- Sandpaper
  - Electrolyte
  - Order number: 71085727

### Electrodes

- Ion-selective electrode
- Electrode, complete, length 120 mm
  - Order numbers:
    - Ammonium: 71109938 (color identification red)
    - Nitrate: 71109937 (color identification blue)
    - Potassium: 71109936 (color identification yellow)
    - Chloride: 71109939 (color identification green)
- pH electrode with reference
- Order number: CPS11-1AT2GSA
- Temperature sensor
- Order number: CTS1-A2GSA
- Dummy electrode
- Order number: 71123812

### Standard solution

#### Ammonium, nitrate, potassium and chloride

Standard solution	
1	Ammonium nitrate, 1 molar
2	Potassium chloride, 1 molar
Container size	
A	250 ml (8.45 fl.oz.)
Transport documents	
1	Standard documents
2	Incl. dangerous goods sheets
3	Safety data sheet
Certificate	
A	None
B	Manufacturer's certificate
CAY40-	Complete order code

**pH***High-quality buffer solutions of Endress+Hauser - CPY20*

The secondary buffer solutions have been referenced to primary reference material of the PTB (German Federal Physico-technical Institute) and to standard reference material of NIST (National Institute of Standards and Technology) according to DIN 19266 by a DKD (German Calibration Service) accredited laboratory.

pH value	
A	pH 2.00 (accuracy ± 0.02 pH)
C	pH 4.00 (accuracy ± 0.02 pH)
E	pH 7.00 (accuracy ± 0.02 pH)
G	pH 9.00 (accuracy ± 0.02 pH)
I	pH 9.20 (accuracy ± 0.02 pH)
K	pH 10.00 (accuracy ± 0.05 pH)
M	pH 12.00 (accuracy ± 0.05 pH)
Quantity	
01	20 x 18 ml (0.68 fl.oz) only buffer solutions pH 4.00 and 7.00
02	250 ml (8.45 fl.oz)
10	1000 ml (0.26 US gal)
50	5000 ml (1.32 US gal) canister for Topcal S
Certificates	
A	Buffer analysis certificate
Version	
1	Standard
CPY20-	complete order code

**Compressed air cleaning****Not suitable for continuous operation!**

- Operating interval: max. 3 minutes cleaning, break for at least six times the cleaning time.
- Avoid condensation in the pressurized hoses.

Cleaning unit in the housing

- 230 V or 115V, IP 65
- Conveying rate at atmospheric pressure: 50 l/min (13.2 gal/min)
- Power consumption: 240 W
- Current consumption: 1.3 A
- Overheating protection: automatic switch off at T > 130 °C (266 °F)
- Order no.
  - 230 V: 71072583
  - 115 V: 71096199
  - Hose reducer coupling AD 8/6 mm: 71082499



---

## Instruments International

Endress+Hauser  
Instruments International AG  
Kaegenstrasse 2  
4153 Reinach  
Switzerland

Tel.+41 61 715 81 00  
Fax+41 61 715 25 00  
[www.endress.com](http://www.endress.com)  
[info@ii.endress.com](mailto:info@ii.endress.com)

**Endress+Hauser**   
People for Process Automation